

In the outstanding Office Action, the drawings were objected to under 37 C.F.R. 1.83(a); claim 8 was objected to due to informalities; claims 1, 4, and 6 were under 35 U.S.C. 103(a) as being unpatentable over Hirose in view of McCormick; claim 8 was rejected as being unpatentable over Hirose in view of Mertol; claims 9-10 were rejected as being unpatentable over Hirose in view of Oshima. Claims 7, 13 and 14 were allowed, and claims 3 and 5 were objected to as being dependent on a rejected base claim, but indicated to be allowable if rewritten in independent form including all the limitations of the rejected base claim.

Drawing Objections

The Office Action asserts that the “thickness of the second metal plate is equal to the thickness of the first metal plate” as recited in claim 3 is not shown. In response, Applicants propose a drawing amendment and a drawing correction as set forth in the Letter Requesting Entry of Drawing Amendment and entry of New Figure wherein Applicants propose to include a new Figure 2B as another embodiment of the present invention, illustrating in detail, for example, the thicknesses of the lower metal plate 13a and the upper metal plate 13b. Page 10, lines 15-20 of the present specification provides support for this amendment. It is respectfully submitted that no new matter is added by way of this amendment.

The Office Action further objected to the drawings as not showing a “cylindrical case” as recited in claim 9, line 14 of the present invention. This objection is moot as claim 9 is now canceled. Applicants, however, note that

cylindrical case 4 is clearly illustrated in Figure 1. Support for this illustration is provided on page 8, line 23 through page 9, line 1.

In view of the above, Applicant requests reconsideration of objections to the drawings under 37 C.F.R. 1.83(a).

OBJECTIONS TO CLAIM 8

Applicants respectfully traverse objections to claim 8 in view of the following:

The structure of claim 8 has one-paragraph preamble and a four-paragraph body. In the body of the claim, the first two paragraphs recite elements forming a semiconductor module, “insulating substrate”, and a “mounting frame,” respectively. The last two paragraphs define specific configurations of the elements recited in paragraphs one and two. Thus, it is believed that the recitation of “and” in line 7 of claim 8 is proper and request that objections to claim 8 be withdrawn.

Claim Rejections – 35 U.S.C. 103

The rejection of claims 1, 4, and 6 under 35 U.S.C. 103(a) as being unpatentable over Hirose further in view of McCormick is respectfully traversed.

As acknowledged by the Office Action, Hirose fails to teach or suggest a mounting frame, having first and second metal plates, including a flange along a periphery thereof for engagement with a peripheral part of the insulating substrate at the first main surface, the flange pressing the peripheral part of the insulating substrate toward the external heat sink to force the insulating substrate into pressure contact with the external heat sink.

The Office Action, however, asserts that McCormick teaches the deficiencies of Hirose and cites to Fig. 2A in support of the assertions. The Office Action cites elements 220 and 206 (cited in Fig. 2A of McCormick) as teaching “...a second metal plate is disposed on the first metal plate and having a protrusion along a periphery thereof projecting from a periphery of the first metal plate to define the flange” as recited in the claimed limitation. These assertions are respectfully traversed for the following reasons:

McCormick identifies element 206 as a first metal layer disposed on top of a substrate 204, and a lower conductive layer 220 provided on an opposite side of the insulating layer 210 (col. 9, lines 48-54; col. 10, lines 5-10). The “first metal layer 206 is suitably supported by an underlying layer 210 of an insulating material....” (col. 9, lines 63-65). From the above disclosure, it is clear that the lower conductive layer 220 is not disposed on the first metal layer 206. Rather, an insulating material 210 separates the lower conductive layer 220 and the first metal layer 206.

Thus, assuming *arguendo*, first metal plate to be 220 and second metal plate to be 206, McCormick neither teaches nor suggests that (i) the second metal plate 206 is disposed on the first metal plate and (ii) having a protrusion along a periphery thereof projecting from a periphery of the first metal plate to define the flange as recited in claim 1 of the present invention.

Therefore, it is believed that the structure of McCormick was modified using impermissible hindsight in order to arrive at the claimed invention. However, disposing an insulating substrate in between the two layers 220 and 206, McCormick teaches away from the present invention. Also, if the insulating material 210 is removed from the structure of McCormick in order to bring the two layers 220 and 206 into contact with each other, such a modification would render McCormick incapable of what it intends to achieve and therefore without any “reasonable expectation of success” if the structure of McCormick were used in Hirose.

It is respectfully noted that when a 35 U.S.C. 103 rejection is based upon a modification of a reference that destroys the intent, purpose or function of the invention disclosed in the reference, such a proposed modification is not proper and the *prima facie* case of obviousness can not be properly made. To overcome the deficiencies of Hirose, the Office Action asserts that "...it would have been obvious... to modify Hirose by using the first and second metal plates of McCormick in the mounting frame of Hirose.” As shown above, this would clearly be a teaching away from what Hirose intends to achieve.

Further, the rationale adopted by the Office Action does not meet the basic requirements for establishing a *prima facie* case of obviousness. To establish a *prima*

facie case of obviousness, first there must be some suggestion or motivation to modify the references or to combine the reference teachings. Even assuming *arguendo* that the Hirose and McCormick references **could be** combined/modified, “the mere fact that it would have been obvious to one skilled in the art does not render the resultant combination obvious unless the prior art also suggests the desirability of the combination.” (emphasis in original; see MPEP §2143.01 Suggestion or Motivation to Modify the References, Chapter 2100, page 123, rev. August, 2001).

Therefore, as noted above, even if, *arguendo*, the teachings of McCormick are used to overcome the deficiencies of Hirose, the requirements of claim 1 are not met. Applicant, therefore, submits that claim 1 is unobvious over prior art of record. Claims 4 and 6 depend from claim 1 and therefore further limit claim 1 in a patentable sense. Since, as described above, Hirose fails to teach or suggest all the elements of claim 1, it is believed that dependent claims 4 and 6 are patentably distinct over Hirose. It is respectfully urged that the rejection of claim 1 and its dependent claims be withdrawn and that they be passed to allowance.

In addition to the above, Applicant respectfully submits that claim 1 is patentably distinct over prior art of record for the following reasons:

Claim 1 recites a semiconductor module mountable on an external heat sink. The semiconductor module comprises an insulating substrate and a mounting frame. The mounting frame is made of metal and has a mounting surface for contact with an external heat sink. The mounting frame includes a flange along a periphery thereof for engagement with a peripheral part of the insulating substrate at a first main surface. The flange is arranged to press the peripheral part of the insulating substrate toward

the external heat sink to force the insulating substrate into pressure contact with the external heat sink. The mounting frame includes a first metal plate and a second metal plate. The first metal plate has the mounting surface. The second metal plate is disposed on the first metal plate and has a protrusion along a periphery thereof projecting from a periphery of the first metal plate to define the flange.

The Office Action asserts that the phrase “to force the insulating substrate into pressure contact with the external heat sink” is functional and that such language does not differentiate the claimed apparatus from Hirose. Applicant respectfully disagrees with this assertion. When evaluating a claim for determining obviousness, all limitations of the claim must be evaluated.

In this regard, it is respectfully noted that

The mere absence [from the reference] of an explicit requirement [of the claim] cannot reasonably be construed as an affirmative statement that [the requirement is in the reference]. See *In re Evanega*, 829 F. 2d 1110, 4 USPQ 2d (Fed. Cir. 1987). It is further noted that “the Examiner cannot dissect a claim, excise the printed matter from it, and declare the remaining portion of the mutilated claim to be unpatentable. The claims must be read as a whole.” See *In re Gulack*, 703 F.2d 1381, 217 USPQ 401 (Fed. Cir. 1983).

Applicant respectfully requests that claim 1 be considered for examination as a whole including the functional language recited therein.

It is believed that Hirose fails to teach or suggest “the flange pressing the peripheral part of the insulating substrate toward the external heat sink to force the insulating substrate into pressure contact with the external heat sink” as recited in claim 1 of the present invention, in addition to the other enumerated deficiencies noted in the Office Action.

Claim 8 was rejected by the Office Action under 35 U.S.C. 103(a) as being unpatentable over Hirose in view of Mertol. The Office Action asserts that Mertol teaches the deficiencies of Hirose and refers to Fig. 8 of Mertol as disclosing an insulative material 6 between the flange 16 and the first conductive pattern and that it would have been obvious to add the insulating material of Mertol in Hirose. These assertions are respectfully traversed.

Mertol discloses a stiffener ring attachment with holes and removable snap-in heat sink or heat spreader. More specifically, Fig. 8 of Mertol discloses that a stiffener 11 is provided with a protrusion 16 that extends into the interior of the stiffener 11 toward the die 1. During encapsulation process, encapsulant 6 flows around the protrusion 16 and once hardened, secures the stiffener 11 to the substrate 2. From this disclosure, one would note that the protrusion 16 is not a flange, and further that the protrusion 16 is not serving to press the periphery of a conductive pattern on which a semiconductor element is mounted toward an external heat sink.

The Office Action asserts that Mertol discloses in Fig. 8 an insulative material 6 between the flange 16 and the first conductive pattern. However, it fails to note where in Mertol the first conductive pattern is. Protrusion 16 is merely used by Mertol to ensure engagement between the protrusion 16 and the encapsulant 6 and the encapsulation process is performed to secure the stiffener 11 to the substrate 2.

Even, assuming *arguendo*, that numeral 3 (conductive traces disposed on substrate 2) to be the first conductive pattern, it is hard for one to understand from Fig. 8 and the related disclosure of Mertol that protrusion 16 is being used to press the periphery of the first conductive pattern. For example, from the illustration of Fig. 8

of Mertol, it is clear that protrusion 16 is not in contact with element 3. However, claim 8 of the present invention requires that said flange presses the periphery of the first conductive pattern. Further, in Mertol, no semiconductor element is mounted on the first conductive pattern 3. However, claim 8 of the present invention requires that a semiconductor element be mounted on the first conductive pattern.

Therefore, even if teachings of Mertol were used in Hirose, it is respectfully submitted that the combination of Mertol and Hirose still fails to teach all the requirements of claim 8 of the present invention. In view of the above, it is believed that claim 8 is unobvious and patentably distinct over prior art of record.

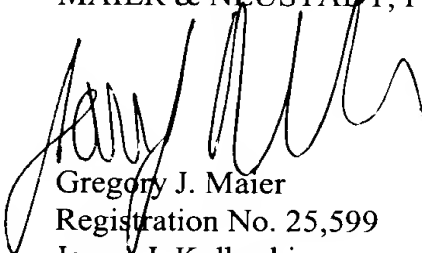
Consequently, in light of the above discussion and in view of the present amendment, the present application is believed to be in condition for allowance and an early and favorable action to that effect is respectfully requested. While it is believed that the instant amendment places the application in condition for allowance, should the Examiner have any further comments or suggestions, it is requested that the Examiner contact the undersigned at 703-413-3000.

Respectfully submitted,

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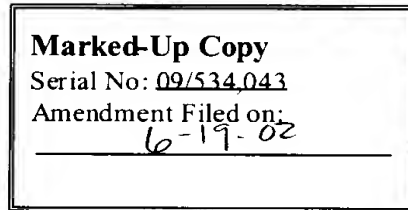
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IN THE SPECIFICATION

Page 7, after line 6, please insert the following paragraph:

Fig. 2B is a cross-sectional view of the semiconductor module shown as mounted on the external heat sink according to a second preferred embodiment of the present invention;

Page 10, lines 14-20, please amend the specification as shown below:

The thickness of the lower metal plate 13a is equal to the sum of the thickness of the ceramic plate 1 and the thickness of the second metal plate 3. The upper metal plate 13b may be of any thickness, but is preferably as thick as the lower metal plate 13a, as shown in Fig. 2B, in consideration for the ease of manufacturing management. The remaining structure of the semiconductor module 19 according to the second preferred embodiment is identical with the corresponding structure of the semiconductor module 18 of the first preferred embodiment in Fig. 1

Page 10, lines 6-13, please change the paragraph to read as follows:

[Fig. 2] Fig. 2A is a cross-sectional view of a semiconductor module 19 shown as mounted on the external heat sink 11 according to a second preferred embodiment

of the present invention. The semiconductor module 19 comprises a double-layer structure including a lower metal plate 13a having a mounting surface for contact with the external heat sink 11 and an upper metal plate 13b secured on the lower metal plate 13a, in place of the metal frame 13 shown in Fig. 1. The inner periphery of the upper metal plate 13b projects inwardly from the inner periphery of the lower metal plate 13a to define a protrusion 21 corresponding to the flange 20 shown in Fig. 1.

Page 13, lines 19-25, please change the paragraph to read as follows:

Fig. 6 is a cross-sectional view of a structure of an insulating substrate 15 for a semiconductor module according to a fifth preferred embodiment of the present invention. The ceramic plate 1, the first metal plate 2 and the second metal plate 3 of the insulating substrate 15 having the structure based on the insulating substrate 17 shown in Figs. 1 and [2] 2A are of a curved configuration such that the outer peripheral part of the mounting surface for contact with the external heat sink 11 warps upwardly away from the external heat sink 11 a distance L (ranging from 0 to 300 μm) above the central part thereof.